Chronic panrhinosinusitis without nasal polyps: Long-term outcome after functional endoscopic sinus surgery

ROLAND GIGER, MD, PAVEL DULGUEROV, MD, DIDIER QUINODOZ, MD, DANIEL LEUBA, MD, BASILE NICOLAS LANDIS, MD, JEAN-SILVAIN LACROIX, MD, PHD, and JEAN PAUL FRIEDRICH, MD, La Chaux-de-Fonds and Geneva, Switzerland

OBJECTIVE: **The goal of this study was to evaluate the long-term outcome after functional endoscopic sinus surgery (FESS) for chronic panrhinosinusitis without nasal polyps by using symptom scoring and an endoscopic outcome evaluation.**

STUDY DESIGN: **Seventy-seven patients with chronic panrhinosinusitis without nasal polyps (Kennedy computed tomography (CT) scan stages I to III) were followed up for at least 3 years after FESS. Preoperative evaluation included a CT scan and an immunoallergologic evaluation. Three years after FESS, all patients were interviewed and scored endoscopically.**

RESULTS: **Ninety-two percent of the patients showed a marked global improvement after FESS. The endoscopic control showed normal findings in 54% of all ethmoidal cavities. The postoperative endoscopic score correlated significantly with the subjective satisfaction ratings ($P < 0.001$). The preoperative CT staging proposed by Kennedy was predictive for necessity of revision surgery in 15% of the patients.**

CONCLUSIONS: **Our data suggest that FESS for chronic panrhinosinusitis without nasal polyps has a good long-term outcome on subjective symptoms and endoscopic findings.**

SIGNIFICANCE: **According to this study, subjective improvement correlates significantly with the postoperative endoscopic findings in the ethmoidal cavities of patients with chronic panrhinosinusitis without polyps at a long-term follow-up.** (Otolaryngol Head Neck Surg 2004;131:534-41.)

From the Department of Otorhinolaryngology and Head and Neck Surgery, Hospital of La Chaux-de-Fonds, La Chaux-de-Fonds (Drs Giger, Quinodoz, Leuba, and Friedrich), and the Department of Otorhinolaryngology and Head and Neck Surgery, University Hospital of Geneva, Geneva, Switzerland (Drs Giger, Dulguerov, Quinodoz, Landis, and Lacroix).

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Reprint requests: Roland Giger, MD, University Hospital of Geneva, Clinic of Otorhinolaryngology and Head & Neck Surgery; Rue Micheli-du-Crest 24, CH-1211 Geneva 14, Switzerland; e-mail, gigerro@hotmail.com.

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Approximately 5% to 15% of the population has chronic rhinosinusitis (CRS).[1] Despite its frequency, precise understanding of the etiology, pathology, and therapy of CRS is lacking.

Functional endoscopic sinus surgery (FESS) is probably one of the most important therapies for CRS. Improvement following FESS for CRS has been reported as very good, with satisfaction reported in up to 98% of patients.[2]

However, most reports were short to medium follow-up series and outcome measurements were based on the subjective improvement of symptoms, disregarding endoscopic findings. In addition, these studies could not demonstrate a correlation between the subjective symptom outcome and endoscopic status.[3,4]

Follow-up and outcome are commonly measured by questionnaires assessing symptom improvement or by using visual analog scales that compare intraindividual changes of preoperative and postoperative scores.[5] Some authors evaluated success by the absence of recurrent disease and the reduction of steroid medication.[6] Most recently, some authors have focused on general quality of life outcome associated with disease-specific validated questionnaires.[7,8] General health status questionnaires, like the Short Form–36 and rhinosinusitis-specific questionnaires (like the Rhinoconjunctivitis Questionnaire[2]) have also been used for this purpose. The number of the measurement tools used makes comparison between different series almost impossible. Vleming and DeVries,[3] Vleming et al,[9] and Kennedy[4] showed the importance of comparing subjective symptom outcome and postoperative endoscopic findings. Their studies revealed that the subjective evaluation of symptom improvement has a different reliability depending on whether polyps were present preoperatively. Although subjective improvement ratings seem comparable to a good endoscopic assessment of the nasal mucosa in CRS patients without nasal polyps, this is not the case for CRS patients with nasal polyposis. Patients with nasal polyposis tend to indicate a good subjective improvement of their CRS symptoms, although a majority show abnormal ethmoidal cavities in the endoscopic evaluation. These findings emphasize the importance of long-term outcome measurements, including both subjective parameters and endoscopic surveillance.

An objective parameter is the computed tomography (CT) scan, which has proved to be useful, especially in quantifying and staging CRS.[10] The CT scan seems to be an excellent method to measure postoperative outcome. Ikeda et al[11] and Franzén and Klausen[12] found a significant reduction of disease extent post-FESS confirmed radiologically.

The studies of Vleming and DeVries,[3] Vleming et al,[9] Kennedy,[4] and others[13] seem to indicate that CRS with or without polyps are probably of different origin, suggesting that a careful patient selection is crucial to properly evaluate postsurgical long-term outcomes.

The primary aims of this study were to evaluate the efficacy and long-term outcome of FESS in CRS patients without polyps and to evaluate the correlation between postoperative subjective outcome in symptoms and postoperative endoscopic appearance.

A secondary aim of this study was to find out if prognostic cofactors exist, which significantly affect the subjective and/or endoscopic outcome in chronic panrhinosinusitis without polyps.

METHODS

Seventy-seven patients with chronic panrhinosinusitis without nasal polyps and without prior ethmoidal surgery were included. All the patients underwent FESS in the Clinic of Otorhinolaryngology and Head & Neck Surgery, Hospital of La Chaux-de-Fonds (Switzerland), from 1989 to 2000. Patients were referred to our outpatient clinics from general practitioners and ENT specialists, and patients consulted directly at our hospital for their sinonasal complaints. Therefore, preoperative treatment was not uniform, ranging from untreated patients, homeopathy, saline lavages, and topical corticosteroids to sporadic systemic corticoid treatment. All patients had demonstrated failure of medical therapy for their sinus problems before surgery.

Each patient had preoperative sinus CT scan. The CT scans were scored by 3 of the authors (R.G., D.Q., and J.P.F.) according to the radiologic staging system proposed by Kennedy[10] (Table 1), and only patients with stage I (bilateral ethmoidal sinus disease) or stages II and III were included. The CT images were also graded according to the radiologic grading of sinus systems proposed by Lund and Mackay[10] (Table 2), and only patients with at least bilateral anterior and posterior ethmoidal mucosal hypertrophy were included. Because of disease involving at least the total ethmoidal sinuses bilaterally, we named this type of CRS chronic panrhinosinusitis (CPRS).

A questionnaire inquiring subjective CRS symptoms (nasal obstruction, facial pain/headache, acute recurrent rhinosinusitis, rhinorrhea, hyposmia) and CRS-related symptoms (such as cough and asthma) was completed by all patients before surgery. The patients rated their postoperative symptom improvement on a visual analog scale during the last follow-up visit, a minimum of 3 years after surgery, in which the left end was labeled "0%," meaning no improvement, and the right end was labeled "100%," meaning best imaginable improvement. This questionnaire also recorded a detailed medical history of each patient (eg, prior sinonasal surgery, general medical problems, smoking habits).

In addition, every patient underwent an allergic testing (prick test) and an immunologic work-up, including the evaluation of a possible immunoglobulin deficiency including IgG subclass deficiencies.

Diagnostic nasal endoscopy and FESS (including at least uncinectomy, middle meatal antrostomy, and total ethmoidectomy on both sides) were performed by the senior author (J.P.F.) in all cases. During FESS, a surgery score was attributed according to the surgery score proposed by Lund and Kennedy[10] (Table 3), and all patients had a minimal score of 4 on each side.

Meticulous endoscopic cleaning was then performed weekly until normal epithelialization was found in the

Table 1. Radiologic staging system proposed by Kennedy[10]

Stage 0	Normal
Stage I	Anatomic abnormalities All unilateral sinus disease Bilateral disease limited to ethmoidal sinuses
Stage II	Bilateral ethmoidal disease with involvement of 1 dependent sinus
Stage III	Bilateral ethmoidal disease with involvement of 2 or more dependent sinuses on each side
Stage IV	Diffuse sinonasal polyposis

Adapted from Kennedy DW. Prognostic factors, outcomes and staging in ethmoid sinus surgery. Laryngoscope 1992;102(suppl 57):1–18.

Table 2. Radiologic grading of sinus systems proposed by Lund and Mackay[10]

Sinus system	Left	Right
Maxillary		
Anterior ethmoidal		
Posterior ethmoidal		
Sphenoidal		
Frontal		
Ostiomeatal complex		
Total points for each side		

Scoring: For all sinus systems, except for the ostiomeatal complex, 0 indicates no abnormalities; 1, partial opacification; 2, total opacification. For the ostiomeatal complex, 0 = not occluded, 2 = occluded.
Adapted from Lund VJ, Mackay IS. Staging in rhinosinusitis. Rhinology 1993;107:183–4.

Table 3. Surgery score proposed by Lund and Kennedy[10]

Surgical procedure	Left	Right
Uncinectomy		
Middle meatal antrostomy		
Anterior ethmoidectomy		
Posterior ethmoidectomy		
Sphenoidectomy		
Frontal recess surgery		
Reduction of the middle turbinate		
Total points of each side		

Scoring: 0 indicates no procedure performed; 1, surgery performed. The total score can range from 0 to 14 (0 to 7 for each side).

Table 4. Postoperative endoscopic scoring of the ethmoidal cavities

		Left	Right
Aspect of the mucosa in the ethmoidal cavity	0 = Normal mucosa 1 = Partially lined with mucosal hypertrophy 2 = Completely lined with mucosal hypertrophy 3 = Polyps		
Purulent discharge	0 = No 1 = Yes		
Middle meatal antrostomy	0 = Open 1 = Closed		

ethmoidal cavities. Patients further received postoperative saline lavages for several weeks and topical corticosteroids were given. These treatments were either continued or discontinued depending on the patients complaints. At the final visit, only a minority of 5 patients still used topical corticosteroids.

Mucosa samples from the ethmoidal cells were stained with hematoxylin-eosin and were examined under a Zeiss microscope at ×40 magnification, and the presence of polyps warranted the exclusion of the patient from the study.

At the final visit at least 3 years after surgery (4 patients of the original cohort could not be located), a nasal endoscopy was performed by the first author (R.G.) to evaluate the endonasal findings according to a postoperative endoscopic score (POES) of the ethmoidal cavities (Table 4). POES is based on previous postoperative endoscopic experience in patients with CRS, with and without polyposis. Each endoscopic examination evaluated the aspect of the mucosa in the ethmoidal cavities. The mucosa was graded between 0 and 3 (0, normal; 1, partially lined with mucosal hypertrophy; 2, completely lined with mucosal hypertrophy; 3, polyps). Presence or absence of purulent discharge was scored as "1" or "0," respectively. In the same way, the opening ("0") or closing ("1") of the middle meatal antrostomy was graded. Thus a total score of 0 to 10 could be obtained, and each side can be considered separately (0 to 5). The endoscopist was not aware of the patients' symptom improvement evaluation.

All revision surgery was performed prior to final evaluation.

Results were analysed using SPSS 10.0 (SPSS Inc, Chicago, IL). Descriptive statistics are presented within the body of the text as mean ± SD. The *t* tests for unpaired samples were used for comparison between groups. Correlation analyses were performed using Spearman statistics. The α level was 0.05.

RESULTS

Seventy-three patients (36 females and 37 males) participated (mean age, 42.7 years; age range, 12 to 75 years). Twenty-three patients were active smokers (32%). The total mean follow-up was 4.8 years, ranging from 3 to 9 years.

Thirteen patients (18%) had asthma. According to the allergy testing, allergies were documented in 37 patients (51%). Inhalant allergies were found in 29 patients (40%). In only 2 patients (3%) was acetylsalicylate acid (ASA) hypersensitivity found. The laboratory evaluation of immunoglobulin deficiency showed IgG subclasses deficiencies in 14 patients (19%), with 13 patients having IgG_3 and 1 patient having IgG_2 deficiency.

Based on the CT findings and according to the staging system proposed by Kennedy[10] (Table 1), 42 patients (58%) fell into stage III group, 27 (37%) into stage II group, and 4 (5%) into stage I group (bilateral ethmoidal sinus disease). To compare the involvement of both sides of the sinuses, CT scans were evaluated according to the radiologic grading of sinus systems proposed by Lund and Mackay[10] (Table 2). There was almost no difference in disease extent between both sides (mean radiologic score of the left/right side, 5.08 ± 2 SD/5.18 ± 2 SD). The mean total score of both sides together was 10.3 ± 4 SD, ranging from 4 to 23.

All patients underwent at least an uncinectomy, total ethmoidectomy, and a middle meatal antrostomy bilaterally. In almost all patients (92%), the extent of surgery was similar on both sides (mean surgery score proposed by Lund and Kennedy[10] [Table 3] of the left/right side, 5.27 ± 0.8 SD/5.29 ± 0.8 SD). The mean total surgery score of both sides together was 10.6 ± 1.6 SD, ranging from 8 to 14. No major intraoperative or postoperative complications were observed. During the postoperative period until the final

Table 5. Number of individuals experiencing improvement for chronic rhinosinusitis–specific and related symptoms and their average degree of improvement at the final visit

Symptoms	No. of patients with improvement after FESS (%)/Total No. of patients with complaint before FESS	Average degree of improvement (%)
Global improvement	69 (95%)/73	80
Facial pain/headache	68 (94%)/72	85
Recurrent rhinosinusitis	66 (96%)/69	85
Rhinorrhea	50 (81%)/62	77
Nasal obstruction	53 (93%)/57	85
Hyposmia	15 (88%)/17	81
Cough	22 (76%)/29	87
Asthma	7 (54%)/13	83

FESS, Functional endoscopic sinus surgery.

visit, 11 patients (15%) underwent revision surgery for residual or recurrent disease. Four of these patients had to undergo more than 1 surgical revision. There were 9 revision ethmoidal surgeries including endoscopic frontal sinusotomy, 4 frontal sinus trephinations, 2 osteoplastic frontal sinusotomies and fat obliteration, and 1 partial middle turbinectomy because of middle meatal adhesions during a period ranging from 0 to 6 years postoperatively. In 7 cases, residual or recurrent frontal sinus disease due to frontal recess obstruction or stenosis was the indication for revision surgery. Residual or recurrent frontal sinus pathology occurred in 13% of the patients with prior endoscopic frontal sinusotomy.

The preoperative evaluation showed that the most common symptoms of the patients were facial pain and headache (98%), recurrent acute rhinosinusitis (95%), and rhinorrhea (85%), followed by nasal obstruction (78%), cough (40%), and hyposmia (23%) (Table 5).

The postoperative evaluation of the outcome reported marked global improvement in 67 patients (92%). Six individuals (8%) reported symptoms to be unchanged or reduced by less than 25%. The global improvement correlated statistically significant with the improvement of each CRS-specific symptom (except hyposmia) and cough as a related symptom ($r = 0.58$ to 0.72, $P < 0.001$). Twenty-two patients (32%) were applying long-term topical steroids postoperatively.

Despite the excellent improvement of subjective rhinosinusitis symptoms, many of the patients had abnormal findings in the cavities of opened ethmoidal sinuses on endoscopic visualization. Cavities were described as normal if there was no evidence of mucosal hypertrophy, an open middle meatal antrostomy, and no purulent discharge. Using these criteria, 54% of all cavities were without any pathology. The exact distribution of the postoperative endoscopic findings is shown in Table 6. Synechiae (2 patients) and septal perforations (3 patients) were rarely observed during endoscopic follow-up. A significant correlation between global symptom improvement respectively improvement of CRS-specific symptoms (except hyposmia) including cough as related symptom, and the POES was identified ($r = -0.35$ to -0.6, $P < 0.001$) (Fig 1). The total POES was "0" in 37 patients (51%). These patients reported a mean global postoperative improvement of 91%. In contrast, the other 36 patients (49%) with a total endoscopic score "≥1" reported a mean global improvement of only 59% ($P < 0.001$). Similar results were found in the CRS-specific symptom improvement and are shown in Figure 2. Table 6 illustrates the postoperative findings, whereas it has to be noted that 12 patients formed de novo nasal polyposis. These patients showed a significantly worse subjective ($P < 0.001$) and objective ($P < 0.001$) outcome.

Comparing the subjective outcome from asthmatic patients and nonasthmatic patients, there was a nonsignificant trend to a better subjective global improvement in nonasthmatics (average improvement, 79%) than in asthmatic patients (average improvement, 61%). In contrast, the comparison of the POES showed a statistically significant difference between asthmatics (average score, 3.3) and nonasthmatics (average score, 1.6) ($P < 0.05$), despite similar radiological extent of disease present preoperatively (mean radiologic score proposed by Lund and Mackay[10] [Table 2] of asthmatics/nonasthmatics: 9.5 ± 3.9 SD/10.4 ± 3.9 SD).

There was no significant difference in subjective outcome between the patients with and without respiratory allergies respectively deficiency of IgG subclasses. When we compared the POES between patients with (average score, 2.9) and without (average score, 1.5) allergies, a significant difference was found ($P < 0.05$), despite similar radiologic extent of disease present preoperatively (mean radiologic score proposed by Lund and Mackay[10] [Table 2] of patients with/without allergies: 10.3 ± 4.6 SD/10.2 ± 3.4 SD).

Table 6. Postoperative endoscopic findings in the ethmoidal cavities (n = 146)

Aspect of the mucosa	No. of ethmoidal cavities (% of total cavities)	No. of purulent discharge (% of cavities)	No. of closed MMA (% of cavities)
Normal mucosa	82 (56)	1 (1)	1 (1)
Partial lining by MH	32 (22)	13 (41)	3 (9)
Complete lining by MH	20 (14)	10 (50)	2 (10)
Polyps	12 (8)	7 (58)	5 (42)
Total	146 (100)	31 (21)	11 (8)

MH, Mucosal hypertrophy; *MMA*, middle meatal antrostomy.

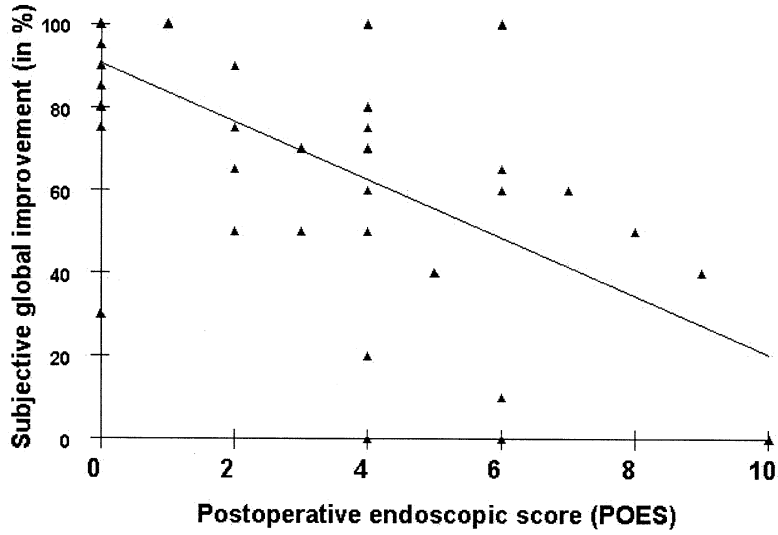

Fig 1. Spearman linear correlation between global symptom improvement and the postoperative endoscopic score (POES) in patients at least 3 years after FESS (n = 73, r = −0.6, $P < 0.001$). Figures for correlation between POES and CRS-specific symptom improvement (except hyposmia) are similar.

Deficiency of IgG subclasses showed no difference in objective outcome compared with the patients with normal IgG subclass levels.

There was no difference between subjective and objective outcome between smokers and nonsmokers. However, smokers had a statistically significant higher score in the radiologic grading of sinus systems proposed by Lund and Mackay[10] (Table 2) than nonsmokers (mean total score, 12.3 versus 9.3; $P < 0.01$).

Comparing symptom improvement and POES with the sinus extent of CRS before surgery, no significant correlation between the subjective outcome, the endoscopic findings, and CT staging proposed by Kennedy[10] (Table 1) or proposed by Lund and Mackay[10] (Table 2) was found.

Interestingly, there was a significant correlation between the preoperative CT staging proposed by Kennedy[10] (Table 1) and the need for revision surgery ($P < 0.001$). Ten of all 11 patients undergoing revision surgery had a stage III, and 1 patient had a stage II according to this CT staging. The presence of greater disease extent preoperatively increased the need of revision surgery during the follow-up period.

DISCUSSION

The major findings of this study are that 1) CPRS patients without nasal polyps treated by FESS exhibit in an overwhelming majority a significant long-term reduction or curing from their symptoms; 2) in these patients, the subjective global improvement ratings, the CRS-specific symptom reductions and the endoscopic findings correlate well; and 3) the preoperative CT staging proposed by Kennedy[10] (Table 1) was the only cofactor predictive for poor outcome with necessity of surgical revision.

Our data confirm the findings of previous series that reported excellent subjective outcome following endoscopic sinus surgery with improvement in 82% to 98% of patients.[2,4] Most follow-up studies published previously cover a postoperative period of less than 2 years. Our results suggest that this satisfying outcome holds for at least 3 years (Table 5).

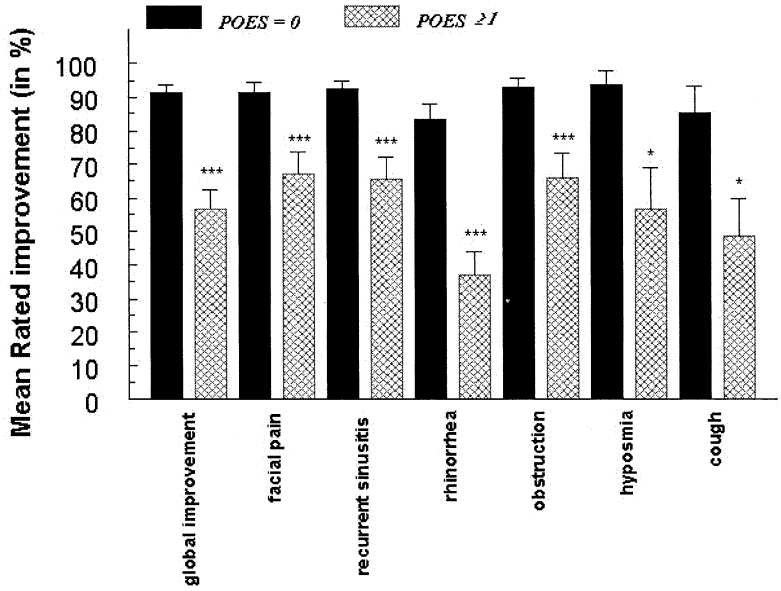

Fig 2. Mean improvement of global and CRS-specific symptoms in patients at least 3 years after FESS with a POES of "0" (n = 37) comparing with patients with a POES of "≥1" (n = 36) (*$P < 0.05$, ***$P < 0.001$).

With respect to CRS-specific symptoms, improvement was noted in 76% to 96% of the patients with preoperative complaints (Table 5). Greatest improvement was seen in facial pain and recurrent acute rhinosinusitis, with 94% and 96% of patients reporting 85% mean improvement (Table 5). Slightly fewer individuals showed an improvement in rhinorrhea, nasal obstruction, cough, and hyposmia (76% to 93%) with a mean improvement of 77% to 87% (Table 5). Fifty-four percent of patients with asthma reported a mean improvement of 83%.

Similarly to Kennedy[4] and Lawson,[14] we showed that asthma is a risk factor associated with worse surgical outcome evaluated by endoscopically postoperative examination ($P < 0.05$). A nonstatistically significant trend of better subjective outcome in nonasthmatic patients was also observed in our study.

Several authors have suggested that inhalant allergy is often a predisposing factor in the development of CRS.[15] Lavigne et al[16] concluded that worsening of symptoms in some patients with CRS after sinus surgery could be the result of an exposure to environmental allergens. Kennedy[4] and Senior et al[17] could not demonstrate that allergy affected outcome after FESS. Our series demonstrated an incidence of positive prick tests for inhalant allergies in 40% and the incidence of reported drug allergies was 11%. We could not show a difference in subjective outcome between patients with and without inhalant allergies, but there was a statistically significant better POES in patients without inhalant allergies ($P < 0.05$). Both asthma and respiratory allergies were associated with worse POESs without affecting the patients' postoperative subjective satisfaction. This discrepancy is most likely due to a preexisting alteration in nasal mucosa consecutive to these hyperreactive states.

After allergy, repeated exposure to upper respiratory infections, air pollution, and anatomic obstruction are excluded as causes of persistent and recurrent infectious rhinosinusitis, immunodeficiency must be considered. Sethi et al[18] and Scadding et al[19] suggested that an immunodeficiency disorder may be present in as many as 50% of adult patients with recurrent acute or CRS. The most common causes of immunodeficiency associated with recurrent CRS are immunoglobulin deficiencies, including IgG subclass deficiencies. Despite a trend to better subjective global outcome in patients with no IgG subclass deficiencies (mean global improvement, 79% versus 64%), we could not show any statistically significant better outcome either subjectively or in endoscopic findings in comparing patients who demonstrate IgG subclass deficiencies.

Smoking is thought to be a possible factor in the etiology of CRS.[20] Our study could demonstrate that smokers had a statistically significant higher score in the radiologic grading of sinus systems proposed by Lund and Mackay[10] (Table 2) than nonsmokers (mean total score, 12.3 versus 9.3; $P < 0.01$), but there was no difference in subjective outcome and postoperative endoscopic findings between these 2 groups.

We could not confirm the statement of Kennedy[4] that the extent of disease before surgery is a significant

prognostic factor by either subjective outcome or postoperative endoscopic findings. An explanation of these different statements could be that we included only CRS without nasal polyps and that we also included patients who required revision surgery prior to the final follow-up evaluation. Diffuse nasal polyposis in fact is influencing the degree of Kennedy's[10] classification of the extent of disease (Table 1). Consequently, because polyposis is included in the series of Kennedy[4] and because high recurrence in nasal polyps in other studies was well demonstrated,[3,9] we are not astonished to obtain different results. However, there was a highly significant correlation between the preoperative CT staging proposed by Kennedy[10] (Table 1) and the need for revision surgery ($P < 0.001$). The presence of greater disease extent preoperatively increased the need of revision surgery.

Few studies have examined the endoscopic outcomes after FESS, and fewer yet compared the postoperative endoscopic findings with subjective outcomes. Vleming and DeVries,[3] Vleming et al,[9] and Kennedy[4] published their results in patients who underwent endoscopic sinus surgery for CRS with and without polyps. They have shown that patient symptoms and endoscopic appearance of the nasal cavities after endoscopic sinus surgery do often not correlate, at least with in the time confines of most follow-up studies.[4] These studies confirm clearly the importance of endoscopic examination and long-term follow-up to detect any persistent or recurrent disease, although no subjective impairment and even improvement of CRS-specific symptoms were remarked.

Based on previous findings of postoperative endoscopic examinations in CRS with and without polyposis, we designed an endoscopic outcome score that includes the aspect of ethmoidal cavity mucosa, the absence or presence of purulent discharge, and the opening or closing of the middle meatal antrostomy (Table 4). Astonishingly, we found 12 ethmoidal cavities (8%) with a postoperative de novo formation of polyps, despite excluding patients with nasal polyposis from the study. These patients showed a lower degree in global postoperative satisfaction. This might indicate that a low postoperative satisfaction in chronic panrhinosinusitis without nasal polyps requires a close and careful follow-up, with the suspicion of a possible de novo formation of polyposis.

A statistically significant correlation was found between this endoscopic outcome score (POES) and the subjective outcome of CRS-specific symptoms (except hyposmia) including cough, and also the global symptom outcome ($r = -0.35$ to -0.6; $P < 0.001$) (Fig 1). The POES was "0" in 37 patients (51%) with a mean global improvement of 91%. In the other 36 patients (49%) with a mean global improvement of 59%, the POES was "≥1" and was concluded as abnormal. In all of these patients, there were only 4 who reported a subjective global improvement of 100%, whereby 1 of them had unilateral purulent discharge from the middle meatal antrostomy but normal ethmoidal cavity mucosa (POES = 1), and a second one was showing an unilateral closed middle meatal antrostomy (POES = 1), also with normal ethmoidal mucosa. The other 32 patients showed a global improvement of 80% or less. These results suggest that patients rating their subjective global outcome improvement after a 3-year follow-up of more than 80%, are likely to have a normal endoscopic finding in the ethmoidal cavities.

Further studies based on this endoscopic outcome score (POES) are planned to address the possibility that such a score could be adopted as prognostic factor for recurrence of disease and need of future revision surgery.

CONCLUSION

The present findings confirm previous data concerning the efficacy of FESS for CRS patients resistant to long-term medical treatment. The good subjective outcome lasts for at least 3 years postoperatively. Furthermore, the endoscopic evaluation of the postoperative ethmoidal cavities (POES) correlates significantly with the patients' subjective improvement ratings. Only the preoperative CT staging proposed by Kennedy,[10] regarding the cofactors evaluated in the medical, rhinologic, and radiologic history of the investigated patients predicted poor outcome with necessity of surgical revision.

A good postsurgical evaluation should include the patient's symptom report and an endoscopic examination in each case during long-term follow-ups. We further propose an endoscopic postsurgical evaluation tool (POES). This postoperative grading system of the ethmoidal cavities needs further evaluation, possibly by other groups, to check its reliability.

REFERENCES

1. Mélen I. Chronic sinusitis: clinical and pathological aspects. Arch Otolaryngol 1994;515(suppl):45-8.
2. Lund VJ. Evidence-based surgery in chronic rhinosinusitis. Acta Otolaryngol 2001;121:5-9.
3. Vleming M, DeVries N. Endoscopic paranasal sinus surgery: results. Am J Rhinol 1990;4:13-7.
4. Kennedy DW. Prognostic factors, outcomes and staging in ethmoid sinus surgery. Laryngoscope 1992;102:1-18.
5. Lund VJ, Holmstrom M, Scadding GK. Functional endoscopic sinus surgery in the management of chronic rhinosinusitis. An objective assessment. J Laryngol Otol 1991;105:832-5.

6. Friedman WH, Katsantonis GP. Intranasal and transantral ethmoidectomy: a 20-year experience. Laryngoscope 1990;100:343-8.
7. Damm M, Quante G, Jungehuelsing M, et al. Impact of functional endoscopic sinus surgery on symptoms and quality of life in chronic rhinosinusitis. Laryngoscope 2002;112: 310-5.
8. Metson RB, Glicklich RE. Clinical outcome in patients with chronic sinusitis. Laryngoscope 2000;110:24-8.
9. Vleming M, Middelweerd MJ, DeVries N. Good results of endoscopic paranasal sinus surgery for chronic or recurrent sinusitis and for nasal polyps. Ned Tijdschr Geneeskd 1993;137:1453-6.
10. Lund VJ, Kennedy DW. International consensus report of the Rhinosinusitis Task Force. Staging for rhinosinusitis. Otolaryngol Head Neck Surg 1997;117(suppl):35-40.
11. Ikeda K, Kondo Y, Sunose H, et al. Subjective and objective evaluation in endoscopic sinus surgery. Am J Rhinol 1996;10: 217-20.
12. Franzén G, Klausen OG. Post-operative evaluation of functional endoscopic sinus surgery with computed tomography. Clin Otolaryngol 1994;19:332-9.
13. Corey JP, Delsupehe KG, Ferguson BJ. Allergic fungal sinusitis: allergic, infectious or both? Otolaryngol Head Neck Surg 1995; 113:110-9.
14. Lawson W. Intranasal ethmoidectomy: an experience with 1077 procedures. Laryngoscope 1991;101:367-71.
15. Krause HF. Allergy and chronic rhinosinusitis. Otolaryngol Head Neck Surg 2003;128:14-6.
16. Lavigne F, Nguyen CT, Cameron L, et al. Prognosis and prediction of response to surgery in allergic patients with chronic sinusitis. J Allergy Clin Immunol 2000;105:746-51.
17. Senior BA, Kennedy DW, Tanabodee J, et al. Long-term results of functional endoscopic sinus surgery. Laryngoscope 1998;108: 151-7.
18. Sethi DS, Winkelstein JA, Lederman H, et al. Immunologic defects in patients with chronic recurrent sinusitis: diagnosis and management. Otolaryngol Head Neck Surg 1995;112: 242-7.
19. Scadding GK, Lund VJ, Darby YC, et al. IgG subclass levels in chronic rhinosinusitis. Rhinology 1994;32:15-9.
20. Chen Y, Dales R, Lin M. The epidemiology of chronic rhinosinusitis in Canadians. Laryngoscope 2003;113:1199-205.